ATTACHMENT B-13
Muskingum River 3: CI 72162, 72254, and 72258[1]

Unit Info./ Activity	215MW/1957[2] CI 72162: Replaced two complete cyclone furnaces, primary burners and related equipment; approved by the Chairman on September 30, 1986, and the Board of Directors on October 29, 1986.[3] CI 72254: Replaced three complete cyclone furnaces, primary burners and related equipment; approved by the Chairman on August 4, 1987, and the Board of Directors on September 23, 1987.[4] CI 72258: Replaced furnace floor tubing; approved by the Chairman on August 4, 1987.[5]
Nature	AEP hired Babcock and Wilcox to fabricate and replace the unit's five cyclone furnaces and furnace floor tubes.[6] The replacements incorporated design improvements.[7] Each was approved by more than 10 people, including the chairman of the board of directors, and was funded as a capital project.[8]
Extent	AEP replaced all five cyclone furnaces, including all headers, secondary air damper assemblies and primary burners.[9] Each cyclone is 9 feet in diameter and weighed 30,000 lbs.[10] The furnace floor tubing consists of 128 tubes forming eight panels 13 tubes wide and two panels 12 tubes wide; each panel is approximately five feet wide.[11] AEP estimated that the three projects would require a total of 38,831 man-hours of labor.[12]
Outage Dates	All three projects were performed during an outage lasting from from June 9, 1988 to September 3, 1988.[13]
Purpose	In 1985, AEP attributed 127,516 MWH of lost generation and 5,008 MWH of curtailment loss ($528,325 in lost sales) to the cyclones and related equipment, and believed that generation would be regained by replacing the cyclones.[14] Replacing the cyclones was also expected to dramatically reduce the annual cyclone maintenance spending by approximately $380,000 per year.[15] Similarly, AEP expected the furnace floor replacement to recover 80,410 hours of lost generation ($337,722 in lost sales), while also reducing maintenance costs by approximately $39,000.[16] The cyclone replacements were also expected extend the "material life" of the equipment, while the furnace floor replacement was expected to "restore the integrity" of the floor "for the expected 20 years of remaining unit life."[17]
Frequency	These projects were the first time any of the cyclones or furnace floor was completely replaced.[18]
Capital Cost	AEP recorded a total capital cost of $4,142,403 for construction and installation of these projects: $1,404,117 for CI 72162, $1,880,986 for CI 72254, and $857,000 for CI 72258.[19]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-216 and 230-239.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145020; Joint Stips. ¶¶161 and 162; Hekking Rpt. (Pl. Ex. 1) at 215.

3. Capital Improvement Req. # 72162 (Jt. Ex. 1) at 1RP001710; Hekking Rpt. (Pl. Ex. 1) at 233, 234.

4. Capital Improvement Req. # 72254 (Jt. Ex. 122) at ARC-CD111064; Hekking Rpt. (Pl. Ex. 1) at 233, 234.

5. Capital Improvement Req. # 72258 (Jt. Ex. 124) at ARC-CD111122; Hekking Rpt. (Pl. Ex. 1) at 233, 234.

6. B & W Invoice, Aug. 19, 1987 (Pl. Ex. 680); B&W Invoice, Sept. 18, 1987 (Pl. Ex. 679); Purchase Order 28417-071-7X, Oct. 8, 1987 (Pl. Ex. 140); Contract Letter MR3-0488, May 17, 1988 (Pl. Ex. 352); Hekking Rpt. (Pl. Ex. 1) at 235-237; Tuppeny Rpt. (Def. Ex. 1524) at 35 and 38.

7. Capital Improvement Req. # 72162 (Jt. Ex. 1) at 1RP001715; Capital Improvement Req. # 72254 (Jt. Ex. 122) at ARC-CD111068; Capital Improvement Req. # 72258 (Jt. Ex. 124) at ARC-CD111124; Hekking Rpt. (Pl. Ex. 1) at 234, 236; Tuppeny Rpt. (Def. Ex. 1524) at 35 and 37.

8. Capital Improvement Req. # 72162 (Jt. Ex. 1) at 1RP001710 and 001714; Capital Improvement Req. # 72254 (Jt. Ex. 122) at ARC-CD111064 and 111067; Capital Improvement Req. # 72258 (Jt. Ex. 124) at ARC-CD111122 and 111124; Hekking Rpt. (Pl. Ex. 1) at 233.

9. Capital Improvement Req. # 72162 (Jt. Ex. 1) at 1RP001710 and 001715; Capital Improvement Req. # 72254 (Jt. Ex. 122) at ARC-CD111064 and 111068; Hekking Rpt. (Pl. Ex. 1) at 233.

10. Specification MR3-0488, Amendments and Clarifications (Pl. Ex. 353) at ARC-MR104733; Hekking Rpt. (Pl. Ex. 1) at 230 and 236; Tuppeny Rpt. (Def. Ex. 1524) at 33.

11. Specification MR3-0488, Amendments and Clarifications (Pl. Ex. 353) at ARC-MR104734; Hekking Rpt. (Pl. Ex. 1) at 236.

12. Capital Improvement Req. # 72162 (Jt. Ex. 1) at 1RP001718; Capital Improvement Req. # 72254 (Jt. Ex. 122) at ARC-CD111071; Capital Improvement Req. # 72258 (Jt. Ex. 124) at ARC-CD111127; Hekking Rpt. (Pl. Ex. 1) at 235-236.

13. Muskingum River Plant, Unit 3 Annual Outage Report, June 9, 1988 to Sept. 3, 1988 (Jt. Ex. 172); Hekking Rpt. (Pl. Ex. 1) at 237-238; Koppe Rpt. (Pl. Ex. 858) at 153.

14. Capital Improvement Req. # 72162 (Jt. Ex. 1) at 1RP001714 and 001719-721; Capital Improvement Req. # 72254 (Jt. Ex. 122) at ARC-CD111067 and 111072-075; Hekking Rpt. (Pl. Ex. 1) at 232 and 234-235; Tuppeny Rpt. (Def. Ex. 1524) at 34.

15. Capital Improvement Req. # 72162 (Jt. Ex. 1) at 1R001719-721; Capital Improvement Req. # 72254 (Jt. Ex. 122) at ARC-CD111072-075; Hekking Rpt. (Pl. Ex. 1) at 234-235.

16. Capital Improvement Req. # 72258 (Jt. Ex. 124) at ARC-CD111128-131; Hekking Rpt. (Pl. Ex. 1) at 234-235.

17. Capital Improvement Req. # 72162 (Jt. Ex. 1) at 1RP001709; Capital Improvement Req. # 72258 (Jt. Ex. 124) at ARC-CD111124; Hekking Rpt. (Pl. Ex. 1) at 234 and 238.

18. Capital Improvement Req. # 72162 (Jt. Ex. 1) at 1RP001714; Capital Improvement Req. # 72258 (Jt. Ex. 124) at ARC-CD111124; Hekking Rpt. (Pl. Ex. 1) at 231 and 237; Tuppeny Rpt. (Def. Ex. 1524) at 36.

19. Work Order Completion Report, 705/2270 (Pl. Ex. 1345); Property Record (Pl. Ex. 1280) at AT003742-747; Hekking Rpt. (Pl. Ex. 1) at 237-238; Larking Rpt. (Pl. Ex. 1189) at 87, 89 and 91.

ATTACHMENT B-14
Muskingum River 4: CI 72163, 72255, and 72259[1]

Unit Info./ Activity	215MW/1958[2] CI 72163: Replaced two complete cyclone furnaces, primary burners and related equipment; approved by the Chairman on September 30, 1986, and the Board of Directors on October 29, 1986.[3] CI 72255: Replaced three complete cyclone furnaces, primary burners and related equipment; approved by the Chairman on August 4, 1987, and the Board of Directors on September 23, 1987.[4] CI 72259: Replaced furnace floor tubing; approved by the Chairman on August 4, 1987.[5]
Nature	AEP hired B&W to fabricate the materials and Legge Associates to install them.[6] Each of the projects included improvements to the design of the replaced components.[7] AEP capitalized the costs of each of the projects.[8]
Extent	AEP replaced all five cyclone furnaces, including all headers, secondary air damper assemblies and primary burners.[9] Each new cyclone was 9 feet in diameter and weighed 30,000 lbs.[10] The furnace floor tubing consists of 128 tubes forming eight panels 13 tubes wide and two panels 12 tubes wide; each panel is approximately five feet wide.[11] AEP estimated that the three projects would require a total of 47,161 man-hours of labor.[12]
Outage Dates	AEP divided these three CIs into two forced outages, replacing two cyclones in an outage lasting from September 10, 1987 to November 18, 1987, and then replacing the remaining three cyclones and furnace floor tubing in an outage lasting from April 21, 1989 to July 2, 1989.[13]
Purpose	In 1985, AEP attributed 115,632 MWH of lost generation ($348,535 in lost sales) to the cyclones and related equipment, and believed that generation would be regained by replacing the cyclones.[14] Replacing the cyclones was also expected to dramatically reduce the annual cyclone maintenance spending by approximately $440,000 per year.[15] Similarly, AEP expected the furnace floor replacement to recover 111,253 hours of lost generation ($467,302 in lost sales), while reducing maintenance costs by approximately $39,000.[16] The cyclone replacements were also expected extend the "material life" of the equipment, while the furnace floor replacement was expected to "restore the integrity" of the floor "for the expected 20 years of remaining unit life."[17]
Frequency	These projects were the first time any of the cyclones or furnace floor was completely replaced.[18]
Capital Cost	AEP recorded a total capital cost of $4,206,974 for construction and installation of these projects: $1,387,062 for CI 72163, $2,031,552 for CI 72255, and $788,360 for CI 72259.[19]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-216, 230-231 and 245-254.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145020; Joint Stips. ¶¶163 and 164; Hekking Rpt. (Pl. Ex. 1) at 215.

3. Capital Improvement Req. # 72163 (Jt. Ex. 107) at 1RP001639; Hekking Rpt. (Pl. Ex. 1) at 246-247.

4. Capital Improvement Req. # 72255 (Jt. Ex. 123) at ARC-CD111080; Hekking Rpt. (Pl. Ex. 1) at 247.

5. Capital Improvement Req. # 72259 (Jt. Ex. 125) at ARC-CD111136; Hekking Rpt. (Pl. Ex. 1) at 248.

6. Contract Letter MR4-0389 (Pl. Ex. 364); Contract Letter MR34-0687, Amendment 1 (Pl. Ex. 652); Specification MR34-0687 (Pl. Ex. 651); B & W Invoice, Aug. 19, 1987 (Pl. Ex. 680); B & W Invoice, Sept. 18, 1987 (Pl. Exs. 678-679); Purchase Order 28417-071-7X, Oct. 8, 1987 (Pl. Ex. 140); Specification MR4-0389 (Pl. Ex. 366); Purchase Order 28441-071-7X, Oct. 27, 1987 (Pl. Ex. 1006); Hekking Rpt. (Pl. Ex. 1) at 249-251; Tuppeny Rpt. (Def. Ex. 1524) at 35 and 38.

7. Capital Improvement Req. # 72163 (Jt. Ex. 107) at 1RP001644; Capital Improvement Req. # 72255 (Jt. Ex. 123) at ARC-CD111084; Capital Improvement Req. # 72259 (Jt. Ex. 125) at ARC-CD111139; Hekking Rpt. (Pl. Ex. 1) at 248; Tuppeny Rpt. (Def. Ex. 1524) at 35 and 37.

8. Work Order Completion Report, 705/2280 (Jt. Ex. 241); Capital Improvement Req. # 72163 (Jt. Ex. 107); Capital Improvement Req. # 72255 (Jt. Ex. 123); Capital Improvement Req. # 72259 (Jt. Ex. 125); Larkin Rpt. (Pl. Ex. 1189) at 93-98; Hekking Rpt. (Pl. Ex. 1) at 246.

9. Capital Improvement Req. # 72163 (Jt. Ex. 107) at 1RP001639; Capital Improvement Req. # 72255 (Jt. Ex. 123) at ARC-CD111080; Hekking Rpt. (Pl. Ex. 1) at 246-247.

10. Specification MR34-0687 (Pl. Ex. 651) at MR112618; Hekking Rpt. (Pl. Ex. 1) at 250-251; Tuppeny Rpt. (Def. Ex. 1524) at 33.

11. Specification MR4-0389 (Pl. Ex. 366) at ARC-MR107083; Hekking Rpt. (Pl. Ex. 1) at 250-251; Koppe Rpt. (Pl. Ex. 858) at 153.

12. Capital Improvement Req. # 72163 (Jt. Ex. 107) at 1RP001648; Capital Improvement Req. # 72255 (Jt. Ex. 123) at ARC-CD111087; Capital Improvement Req. # 72259 (Jt. Ex. 125) at ARC-CD111142; Hekking Rpt. (Pl. Ex. 1) at 248 and 250.

13. Muskingum River Unit 4 Annual Outage Report, 1987 (Pl. Ex. 657) at MR123152-153 and 123188; Muskingum River Unit 4 Annual Outage Report, Apr. 21, 1989 to July 2, 1989 (Pl. Ex. 372) at ARC-MR108477; Koppe Rpt. (Pl. Ex. 858) at 157; Hekking Rpt. (Pl. Ex. 1) at 251-252.

14. Capital Improvement Req. # 72163 (Jt. Ex. 107) at 1RP001649-651; Capital Improvement Req. # 72255 (Jt. Ex. 123) at ARC-CD111088-090; Hekking Rpt. (Pl. Ex. 1) at 246 and 249; Tuppeny Rpt. (Def. Ex. 1524) at 34.

15. Capital Improvement Req. # 72163 (Jt. Ex. 107) at 1RP001649-651; Capital Improvement Req. # 72255 (Jt. Ex. 123) at ARC-CD111088-090; Hekking Rpt. (Pl. Ex. 1) at 249.

16. Capital Improvement Req. # 72259 (Jt. Ex. 125) at ARC-CD111143-146; Hekking Rpt. (Pl. Ex. 1) at 249; Tuppeny Rpt. (Def. Ex. 1524) at 36.

17. Capital Improvement Req. # 72163 (Jt. Ex. 107) at 1RP001638; Capital Improvement Req. # 72259 (Jt. Ex. 125) at ARC-CD111139; Hekking Rpt. (Pl. Ex. 1) at 253.

18. Capital Improvement Req. # 72163 (Jt. Ex. 107) at 1RP001644; Capital Improvement Req. # 72259 (Jt. Ex. 125) at ARC-CD111139; Hekking Rpt. (Pl. Ex. 1) at 245 and 252.

19. Work Order Completion Report, 705/2280 (Jt. Ex. 241); Property Record (Pl. Ex. 1280) at AT003749-751 and 003755-757; Work Order Completion Report, 705/3320 (Pl. Ex. 636); Hekking Rpt. (Pl. Ex. 1) at 252; Larkin Rpt. (Pl. Ex. 1189) at 94, 96 and 98.

ATTACHMENT B-15
Muskingum River 4: CI 72398[1]

Unit Info./ Activity	215 MW/1958[2] CI 72398: Replaced secondary superheater outlet headers and legs; approved by the Chairman on November 7, 1988.[3] CI 72398, Rev. 1: Reduced approval amount by $183,000; approved on March 26, 1990.[4]
Nature	AEP obtained outside services "because there is not enough plant manpower to accomplish all of the planned work and some of the contractors are needed because of specialty jobs, which the plant is not equipped to handle."[5] AEP hired Babock & Wilcox to make the new components and Phillips Getschow Company to install them.[6] The project was approved by more than 10 AEP officials, including the company president and the chairman of the board of directors.[7] The costs of the project were capitalized.[8]
Extent	The new headers weigh approximately 24,000 pounds each.[9] There are a combined 285 secondary superheater outlet tubes connected to the two headers.[10] AEP estimated it would take more than 10,300 man-hours to remove the old components and install their replacements.[11] Getschow began work approximately three weeks before the outage start date, installing a monorail and trolley track to be used for the removal and reinstallation of the two headers.[12]
Outage Dates	The outage lasted from April 21, 1989 through July 2, 1989.[13]
Purpose	AEP staff determined that "the existing equipment has reached a severely deteriorated state and must be replaced for Unit 4 to be a dependable source of generation."[14] The secondary superheater outlet leg tube failures had been responsible for two forced outages in the six months preceding the preparation of the CI that lasted six days each.[15] In addition, cracks were identified on 277 out of the 285 outlet leg to header welds on Unit 3, which lead AEP to believe Unit 4's condition was similar after conducting a limited inspection of Unit 4.[16] AEP expected that the replacement would "allow for continued unit operation and reliability," and also "reduce future unit maintenance costs."[17] AEP projected that without replacement, the existing outlet legs would cause 288 hours of outage time per year in 1989, increasing 10% per year until the headers and legs were replaced.[18] AEP projected the new headers and outlet legs would cause no loss of equivalent availability, at least for the next 20 years.[19]
Frequency	The replaced components were all original to the unit.[20]
Capital Cost	$480,467[21]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-216 and 266-271.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145020; Joint Stips. ¶¶163 and 164; Hekking Rpt. (Pl. Ex. 1) at 215.

3. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100427; Hekking Rpt. (Pl. Ex. 1) at 267.

4. Capital Improvement Req. 72938, Rev. 1 (Jt. Ex. 217); Improvement Requisition Approval Notice, Nov. 7, 1988 (Pl. Ex. 1207).

5. Annual Outage Plans-1989, Unit 4, Mar. 3, 1989 at ARC-MR105551 (Pl. Ex. 384); Hekking Rpt. (Pl. Ex. 1) at 268.

6. Purchase Order No. 06096-071-8X, Nov.16, 1988 (Pl. Ex. 77); AEP Memo for Purchase Requisition No. 06096-071-8, Nov. 9, 1988 (Pl. Ex. 78); Purchase Order No. 00647-071-9X, Mar. 8, 1989 (Pl. Ex. 76); Specification MR4-0489, Mar. 3, 1989 (Pl. Ex. 369); Contract C-7560, Apr. 19, 1989 (Pl. Ex. 368); Unit 4 1989 Annual Outage Jobs Completed, June 28, 1989 (Pl. Ex. 643) at MR110124; Tuppeny Rpt. (Def. Ex. 1524) at 41; Hekking Rpt. (Pl. Ex. 1) at 268-269.

7. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100427.

8. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100429; Hekking Rpt. (Pl. Ex. 1) at 268.

9. Specification MR4-0489, Mar. 3, 1989 (Pl. Ex. 369); Phillips Getschow Proposal, MR-4, Apr. 3, 1989 (Pl. Ex. 370); Hekking Rpt. (Pl. Ex. 1) at 269.

10. Specification MR4-0489, Mar. 3, 1989 (Pl. Ex. 369); Phillips Getschow Proposal, MR-4, Apr. 3, 1989 (Pl. Ex. 370); Hekking Rpt. (Pl. Ex. 1) at 269; Tuppeny Rpt. (Def. Ex. 1524) at 40.

11. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100433.

12. Phillips Getschow Proposal, MR-4, Apr. 3, 1989 (Pl. Ex. 370); Hekking Rpt. (Pl. Ex. 1) at 270.

13. Muskingum River Unit 4 Annual Outage Report, Apr. 21, 1989 to July 2, 1989 (Jt. Ex. 75) at MR110129-130; Hekking Rpt. (Pl. Ex. 1) at 268.

14. Purchase Req. No. 06096-071-8, Nov. 9, 1988 (Pl. Ex. 78).

15. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100429; Hekking Rpt. (Pl. Ex. 1) at 267.

16. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100429; Tuppeny Rpt. (Def. Ex. 1524) at 40.

17. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100429; Hekking Rpt. (Pl. Ex. 1) at 267-268.

18. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100434; Hekking Rpt. (Pl. Ex. 1) at 268; Koppe Rpt. (Pl. Ex. 858) at 161.

19. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100435; Koppe Rpt. (Pl. Ex. 858) at 161.

20. Capital Improvement Req. # 72398 (Jt. Ex. 218) at ARC-PROAC-CAN100429; Hekking Rpt. (Pl. Ex. 1) at 267.

21. Property Record (Pl. Ex. 1280) at AT003750, 003752 and 003755-757; Larkin Rpt. (Pl. Ex. 1189) at 99; Hekking Rpt. (Pl. Ex. 1) at 270.

ATTACHMENT B-16
Muskingum River 4: CI 72850 and 72875[1]

Unit Info./ Activity	215 MW/1958[2] CI 72850: Replaced the reheat outlet headers and leg tubes; approved on April 12, 1996.[3] CI 72875: Replaced the reheat intermediate header and reheat intermediate and outlet bank of tubes; approved on January 21, 1997.[4]
Nature	AEP hired Babcock & Wilcox to make the new components.[5] The new intermediate header and intermediate and outlet pendants included "material design changes" to "help ensure that the new pendants and header will last until the end of the unit's service life."[6] AEP also upgraded the design of two new reheat outlet headers, with increased ligament spacing between tube stub holes, a smaller outside diameter, and improved materials.[7] Only certain contractors were allowed to bid on the project because the design and manufacture of the new headers was "not a replacement in kind, nor a routine normal duplication, nor a reverse engineering project."[8] The costs of the project were capitalized.[9]
Extent	AEP estimated it would take more than 38,800 man-hours to remove the old components and install their replacements.[10] The replaced reheater outlet bank consisted of 46 platen elements (8 tubes to a platen, or 368 tubes total), hanging from the roof, stretched sidewall to sidewall.[11] The replaced reheater intermediate bank consisted of 21 elements across the width of the boiler.[12] Delays forced AEP to operate Unit 4 at below optimum rating, dealing with an increasing number of forced outages and growing expenditures for in situ repairs.[13]
Outage Dates	The outage lasted from March 30, 2001 to June 3, 2001 .[14]
Purpose	AEP worried that cracks in the reheat outlet headers and legs would lead to a catastrophic through-wall ligament failure and felt replacing them would "eliminate a potential cause of prolonged forced outages."[15] The reheater intermediate and outlet pendants had already caused an average of two forced outages per year preceding the preparation of the CI.[16] In an effort to avoid more outages, AEP minimized the cycling of Unit 4 and lowered the reheat steam temperature by 50 degrees.[17] AEP projected the existing reheater banks, if not replaced would cause 433 EFPH per year of lost unit equivalent availability in 1999, and 576 EFPH per year in 2000-2002.[18] AEP expected that the replacement of the pendants, "in conjunction with replacement of the reheat outlet headers" would allow AEP to "relax the cycling restraints and provide flexibility for System operations."[19]
Frequency	The Reheat Outlet Headers and Leg Tubes were original to the unit.[20] The reheat outlet pendants were previously replaced two other times in the history of the unit in 1968 and 1981.[21] The reheat intermediate pendants were previously replaced one other time in the history of the unit in 1981.[22]

Capital Cost	CI 72850: $920,849[23] CI 72875: $5,145,145[24]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-216 and 254-261.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145020; Joint Stips. ¶¶163 and 164; Hekking Rpt. (Pl. Ex. 1) at 215.

3. Capital Improvement Req. # 72850 (Jt. Ex. 116) at AEPHQ224173; Hekking Rpt. (Pl. Ex. 1) at 256 and 258.

4. Capital Improvement Req. # 72875 (Jt. Ex. 115) at AEPHQ224137; Hekking Rpt. (Pl. Ex. 1) at 256 and 258.

5. Muskingum River 3 & 4 Purchase Orders (Pl. Ex. 142) at AEPHQ157674, 157710 and 157730; Purchase Order 25274-071-5X, Jul. 24, 1997 (Pl. Ex. 68); B&W Invoice No. 635-07-50034, Jul. 17, 1997 (Pl. Ex. 70); Tuppeny Rpt. (Def. Ex. 1524) at 45; Hekking Rpt. (Pl. Ex. 1) at 258-59.

6. Capital Improvement Req. # 72875 (Jt. Ex. 115) at AEPHQ224146; Tuppeny Rpt. (Def. Ex. 1524) at 43; Hekking Rpt. (Pl. Ex. 1) at 257.

7. MR Units 3 and 4 Workscope to Replace RH Outlet Headers and Legs, Jun. 9, 1995 (Pl. Ex. 189) at AEPHQ220499; Superheater and Reheater Replacements AEP/B&W Partnership (Pl. Ex. 648) at MR112580; B & W Preliminary Drawings (Pl. Ex. 649); Hekking (Pl. Ex. 1) at 257.

8. MR Units 3 and 4 RH Outlet Headers and Legs Bidder Approval, Aug. 8, 1995 (Pl. Ex. 188); Hekking (Pl. Ex. 1) at 357-258.

9. Capital Improvement Req. # 72850 (Jt. Ex. 116); Capital Improvement Req. # 72875 (Jt. Ex. 115); Hekking Rpt. (Pl. Ex. 1) at 256.

10. Capital Improvement Req. # 72850 (Jt. Ex. 116) at AEPHQ224169; Capital Improvement Req. 72875 (Jt. Ex. 115) at AEPHQ224139.

11. MR Units 3 and 4 Workscope to Replace RH Outlet Headers and Legs, Jun. 9, 1995 (Pl. Ex. 189); Superheater and Reheater Replacements AEP/B&W Partnership (Pl. Ex. 648); Tuppeny Rpt. (Def. Ex. 1524) at 42; Hekking Rpt. (Pl. Ex. 1) at 254.

12. Superheater and Reheater Replacements AEP/B&W Partnership (Pl. Ex. 648); Tuppeny Rpt. (Def. Ex. 1524) at 42; Hekking Rpt. (Pl. Ex. 1) at 255.

13. Tuppeny Rpt. (Def. Ex. 1524) at 43.

14. Koppe Rpt.(Pl. Ex. 858) at 167 (GADS event data provided by AEP on CD); Hekking Rpt. (Pl. Ex. 1) at 260.

15. Capital Improvement Req. # 72850 (Jt. Ex. 116) at AEPHQ224167; Capital Improvement Req. # 72875 (Jt. Ex. 115) at AEPHQ224146; MR Units 3 & 4 Proposed Temporary Reduction of Reheat Steam Temperatures, Mar. 3, 2000 (Pl. Ex. 653); Tuppeny Rpt. (Def. Ex. 1524) at 43; Hekking Rpt. (Pl. Ex. 1) at 256.

16. Capital Improvement Req. # 72875 (Jt. Ex. 115) at AEPHQ224146; Hekking Rpt. (Pl. Ex. 1) at 256.

17. Capital Improvement Req. # 72850 (Jt. Ex. 116) at AEPHQ224167; Capital Improvement Req. # 72875 (Jt. Ex. 115) at AEPHQ224146; Hekking Rpt. (Pl. Ex. 1) at 256; Tuppeny Rpt. (Def. Ex. 1524) at 43.

18. Capital Improvement Req. # 72875 (Jt. Ex. 115); Koppe Rpt. (Pl. Ex. 858) at 168.

19. Capital Improvement Req. # 72875 (Jt. Ex. 115) at AEPHQ224146; Hekking Rpt. (Pl. Ex. 1) at 256.

20. Capital Improvement Req. # 72850 (Jt. Ex. 116) at AEPHQ224167; Hekking Rpt. (Pl. Ex. 1) at 255.

21. Capital Improvement Req. # 72875 (Jt. Ex. 115) at AEPHQ224146; Hekking Rpt. (Pl. Ex. 1) at 255.

22. Capital Improvement Req. # 72875 (Jt. Ex. 115) at AEPHQ224146; Hekking Rpt. (Pl. Ex. 1) at 255.

23. Book Summary Acct. Page, CI 72850 (Pl. Ex. 1350); Larkin Rpt. (Pl. Ex. 1189) at 104; Hekking Rpt. (Pl. Ex. 1) at 260.

24. Book Summary Acct. Page, CI 72875 (Pl. Ex. 1987); Larkin Rpt. (Pl. Ex. 1189) at 103; Hekking Rpt. (Pl. Ex. 1) at 260.

ATTACHMENT B-17
Muskingum River 5: CI 71450, 71505, and 71665[1]

Unit Info./ Activity	585 MW/1968[2] CI 71450: Replaced five existing CR77 pulverizers with new MPS-89 pulverizers and installed ten additional burners on front and rear walls of primary furnace; approved by AEP Management on March 28, 1978.[3] CI 71505: Replaced primary superheater with wingwalls in primary furnace and replaced horizontal reheat section; approved by AEP Management on June 27, 1978.[4] (This project was revised twice, first increasing the approval amount then decreasing it.)[5] CI 71665: Replaced furnace hopper front slope complete with structural membranes; approved by the AEP Board of Directors on January 30, 1980.[6]
Nature	The projects addressed by CI 71450, CI 71505, and CI 71665 were called the "Big Fix" by AEP employees.[7] AEP hired Babcock & Wilcox to conduct an engineering study for the "Big Fix," fabricate the wingwalls and new reheater, and install them.[8] CI 71505, Rev. 2 was approved by more than 10 AEP officials, including the company president and the chairman of the board of directors.[9] CI 71450 was approved by at least 6 AEP officials.[10] CI 71665 was approved by at least 9 AEP officials, including advanced approval by the president and recommendation by the executive committee.[11] The costs of the projects were capitalized.[12]
Extent	A total of 270,101 hours were expended by B&W in completing the primary superheat and reheat projects, 67,205 hours were expended on the installation of the pulverizer and ten additional burners, and an estimated 10,700 hours were needed to replace the furnace hopper slope.[13] AEP submitted a purchase order to Babcock & Wilcox for the new wingwalls and horizontal reheater over one and one half years prior to the outage.[14] The project included: thirteen wingwall tube banks each containing 49 tubes; thirteen wingwall inlet headers and outlet headers; one primary superheater outlet header; lower reheat tube bank 125 tube rows wide and 18 tubes in height; top of reheat tube bank 125 tubes across and 24 tubes in height; and elimination of gas re-circulation and tempering.[15] The existing horizontal high pressure reheat surface was replaced adding extra surface and wider side-to-side spacing.[16] AEP concluded that the CR77 pulverizers would require "major design changes" because they were "obsolete, out of production, and engineering by the manufacturer to improve it ha[d] ceased."[17] Ten burners were installed in addition to the existing 20 burners, and the burner elbows were ceramic lined to increase resistance to wear.[18] The entire front hopper slope was replaced complete with structural supports.[19] These projects required the installation of elevators, cranes, a 3-drum tugger and a monorail.[20]
Outage Dates	The outage lasted from April 11, 1980 to August 9, 1980.[21] The replacement of the CR77 pulverizers with the MPS pulverizers, which did not require an outage, was complete and the MPS pulverizers were put into service on November 26, 1979.[22]

Purpose	AEP expected to recover 60 MW in capacity (50 MW due to erosion and 10 MW due to slagging) with these projects.[23] This amounted to $1,824,000 per year.[24] In addition, AEP expected replacement of the pulverizers and burners would improve unit availability by 1 to 2% and save it $250,000 per pulverizer on major rebuilds.[25] It expected installing the wingwalls and replacing the horizontal reheater would recover an average of 330,000 megawatt-hours of lost generation, or $2,640,000 per year, and permit Unit 5 to operate at its rated steam flow.[26] Finally, AEP expected replacing the front furnace hopper slope would eliminate stress cracking and numerous tube leaks which could lead to two forced outages, of four days each, per year, and make it impossible for AEP to return Unit 5 to its full load of 600MW.[27] Following the "Big Fix," Unit 5 operated at 585 MW net and at times even higher, up to 600 MW, and availability and capacity improved resulting in an annual value to AEP of $12,900,000.00.[28]
Frequency	The primary superheater and first reheater, and the pulverizers were all original to the unit.[29]
Capital Cost	CI 71505: $13,752,825 for replacement and retirement.[30] CI 71450: $9,951,106 for removal and installation.[31] CI 71665: $520,304 for installation.[32] Total for the three activities: $22,157,053

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-216 and 271-284.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145020; Joint Stips. ¶¶165 and 166; Hekking Rpt. (Pl. Ex. 1) at 216.

3. Capital Improvement Req. # 71450 (Jt. Ex. 133) at ARC-CORPB-COL228589; Approval of Improvement Requisition, Apr. 6, 1978 (Pl. Ex. 1242); Hekking Rpt. (Pl. Ex. 1) at 276 and 279.

4. Capital Improvement Req. # 71505 (Jt. Ex. 108) at 1RP 1946; Approval of Improvement Requisition, July 12, 1978 (Pl. Ex. 393); Hekking Rpt. (Pl. Ex. 1) at 276 and 279; Tuppeny Rpt. (Def. Ex. 1524) at 81.

5. Capital Improvement Req. # 71505, Rev. 1 (Jt. Ex. 182) at 1RP001937; Capital Improvement Req. # 71505, Rev. 2 (Jt. Ex. 212) at ARC-CORPB-COL229282.

6. Capital Improvement Req. # 71665 (Jt. Ex. 141) at ARC-PROAC-CAN103338; Hekking Rpt. (Pl. Ex. 1) at 277 and 279.

7. 600 MW Unit Big Fix Modifications, Mar. 21, 1977 (Pl. Ex. 1030); Hekking Rpt. (Pl. Ex. 1) at 277.

8. B & W Letter, Material Proposal-Primary Superheater Wingwalls and Replacement Horizontal Reheater, Feb. 16, 1978 (Pl. Ex. 391) at ARC-MR165042; Draft Engineering Study for AEP,

Muskingum Unit 5, Apr. 14, 1976 (Pl. Ex. 395) at ARC-MR165212; Tuppeny Rpt. (Def. Ex. 1524) at 81; Hekking Rpt. (Pl. Ex. 1) at 278.

9. Capital Improvement Req. # 71505, Rev. 2 (Jt. Ex. 212) at ARC-CORPB-COL229282.

10. Capital Improvement Req. # 71450 (Jt. Ex. 133) at ARC-CORPB-COL228589.

11. Capital Improvement Req. # 71665 (Jt. Ex. 141) at ARC-PROAC-CAN103338.

12. Capital Improvement Req. # 71450 (Jt. Ex. 133); Capital Improvement Req. 71505 (Jt. Ex. 108); Capital Improvement Req. # 71665 (Jt. Ex. 141); Larkin Rpt. (Pl. Ex. 1189) at 107 and 109-110.

13. B & W Manhours Comparison, Oct. 27, 1980 (Pl. Ex. 55); Capital Improvement Req. 71665 (Jt. Ex. 141) at ARC-PROAC-CAN103343; Hekking Rpt. (Pl. Ex. 1) at 281.

14. Tuppeny Rpt. (Def. Ex. 1524) at 81.

15. B&W Letter, Material Proposal-Primary Superheater Wingwalls and Replacement Horizontal Reheater, Feb. 16, 1978 (Pl. Ex. 391) at ARC-MR165043; Hekking Rpt. (Pl. Ex. 1) at 278.

16. B&W Letter, Material Proposal-Primary Superheater Wingwalls and Replacement Horizontal Reheater, Feb. 16, 1978 (Pl. Ex. 391) at ARC-MR165042; Hekking Rpt. (Pl. Ex. 1) at 278; Tuppeny Rpt. (Def. Ex. 1524) at 82.

17. Capital Improvement Req. # 71450 (Jt. Ex. 133) at ARC-CORPB-COL228592; Tuppeny Rpt. (Def. Ex. 1524) at 85; Hekking Rpt. (Pl. Ex. 1) at 275.

18. B&W Letter, Material Proposal-Primary Superheater Wingwalls and Replacement Horizontal Reheater, Feb. 16, 1978 (Pl. Ex. 391) at ARC-MR165042; Capital Improvement Req. # 71450 (Jt. Ex. 133) at ARC-CORPB-COL228592.

19. Capital Improvement Req. # 71665 (Jt,. Ex. 141) at ARC-PROAC-CAN103338; Tuppeny Rpt (Def. Ex. 1524) at 87.

20. Trip Report, Apr. 19, 1979 (Pl. Ex. 390); Hekking Rpt. (Pl. Ex. 1) at 279 and 280-281.

21. Muskingum Unit 5 Outage, April 11, 1980 to August 9, 1980 (Jt. Ex. 174) at MR133055; Hekking Rpt. (Pl. Ex. 1) at 280; Koppe Rpt. (Pl. Ex. 858) at 171; Tuppeny Rpt. (Def. Ex. 1524) at 83.

22. Partial In Service Report, July 12, 1979 (Jt. Ex. 43); Koppe Rpt. (Pl. Ex. 858) at 171; Hekking Rpt. (Pl. Ex. 1) at 280; Tuppeny Rpt. (Def. Ex. 1524) at 86.

23. Capital Improvement Req. # 71450 (Jt. Ex. 133) at ARC-CORPB-COL228591-592; Capital Improvement Req. # 71505 (Jt. Ex. 108) at 1RP 1948-1949; Capital Improvement Req. # 71665 (Pl. Ex. 141) at ARC-PROAC-CAN103340; 600 MW Big Fix Modifications (Pl. Ex. 1030) at CD143089; Hekking Rpt (Pl. Ex. 1) at 274, 276 and 282-283; Tuppeny Rpt. (Def. Ex. 1524) at

80, 83 and 85.

24. Capital Improvement Req. # 71450 (Jt. Ex. 133) at ARC-CORPB-COL228598; Capital Improvement Req. # 71505 (Jt. Ex. 108) at 1RP 1949.

25. Capital Improvement Req. # 71450 (Jt. Ex. 133) at MR119665; Economic Review, CR/MPS Pulverizer and Burners (Jt. Ex. 256) at CD144240-265; Hekking Rpt. (Pl. Ex. 1) at 275 and 277; Koppe Rpt. (Pl. Ex. 858) at 173.

26. Capital Improvement Req. # 71505 (Jt. Ex. 108) at 1RP 1948 and 1949; Michael B. Doherty Depo. at 108:23-109:7; Hekking Rpt. (Pl. Ex. 1) at 274-276; Tuppeny Rpt. (Def. Ex. 1524) at 82.

27. Capital Improvement Req. # 71665 (Jt. Ex. 141) at ARC-PROAC-CAN103340.

28. Muskingum River 5 Unit Rating, June 24, 1981 (Jt. Ex. 27); Heat Rate Related Component Improvements (Pl. Ex. 57); Hekking Rpt. (Pl. Ex. 1) at 282.

29. Tuppeny Rpt. (Def. Ex. 1524) at 77; Koppe Rpt. (Pl. Ex. 858) at 172; Hekking Rpt. (Pl. Ex. 1) at 281.

30. Property Record (Pl. Ex. 1280) at AT003767-773; Work Order Completion Report, 704/3620 (Pl. Ex. 179) at AEPHQ202804; Work Order Completion Report, 804/3620 (Jt. Ex. 5); Tuppeny Rpt. (Def. Ex. 1524) at 84; Larkin Rpt. (Pl. Ex. 1189) at 107; Hekking Rpt. (Pl. Ex. 1) at 281.

31. Property Record (Pl. Ex. 1280) at AT003766-767 and 003769-772; Work Order Completion Report, 704/2940 (Jt. Ex. 199); Larkin Rpt. (Pl. Ex. 1189) at 109; Hekking Rpt. (Pl. Ex. 1) at 281.

32. Property Record (Pl. Ex. 1280) at AT003767; Work Order Completion Report, 704/5240 (Jt. Ex. 200); Larkin Rpt. (Pl. Ex. 1189) at 110; Hekking Rpt. (Pl. Ex. 1) at 282.

ATTACHMENT B-18
Muskingum River 5: CI 72202[1]

Unit Info./ Activity	585 MW/1968[2] CI 72202: Replaced five 700 HP primary air fan motors with five 900 HP motors; approved on October 29, 1986.[3]
Nature	AEP replaced the original 700 HP primary air fan motors with new, larger 900 HP motors.[4] AEP purchased the 900 HP motors from Siemens Energy & Automation at a cost of $32,363.57 each.[5] The costs of the project were capitalized.[6]
Extent	The new larger 900 HP motors required adapter bases.[7] The 900 HP motors required the installation of a larger power supply cable.[8]
Outage Dates	A unit outage was not necessary to complete installation.[9] Replacement of the first motor started on March 23, 1988 or soon thereafter.[10] The final new 900 HP motor was placed in service on September 15, 1988.[11]
Purpose	Prior to the replacement of the 700 HP motors, the MPS pulverizers, which were installed as part of the "Big Fix," were limited to a loading of 108,000 lbs coal per hour.[12] AEP expected the replacement of the 700 HP motors with the 900 HP motors would allow the pulverizers to perform at to their design rate of 120,000 lbs coal per hour.[13] The replacements were expected to do a number of things including: eliminating a 20 to 50 MW curtailment, thereby allowing Unit 5 to operate at its full load capacity of 585 MW; reducing load curtailments by at least 25,000 MW-hours per year; and obtain a net savings of $1,246,000.[14] AEP also expected the additional electrical generation available for sale to be worth $81,245 per year (escalated at 6% per year).[15] The 900 HP motors' service life was estimated at 30 years, which matched the remaining service life of Unit 5.[16]
Frequency	The replaced components were all original to the unit.[17]
Capital Cost	$289,750 for replacement and retirement.[18]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-216 and 284-288.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145020; Joint Stips. ¶¶165 and 166; Hekking Rpt. (Pl. Ex. 1) at 216.

3. Capital Improvement Req. # 72202 (Jt. Ex. 250) at 1RP002200; Approval Notice, Oct. 31, 1986 (Pl. Ex. 130); Hekking Rpt. (Pl. Ex. 1) at 286 and 287.

4. Capital Improvement Req. # 72202 (Jt. Ex. 250) at 1RP002200; Hekking Rpt. (Pl. Ex. 1) at 286.

5. Purchase Order 01759-071-7X, Mar. 26, 1987 (Pl. Ex. 669); Work Order Completion Report, 705/2310 (Jt. Ex. 77); Hekking Rpt. (Pl. Ex. 1) at 287.

6. Capital Improvement Req. # 72202 (Jt. Ex. 250) at 1RP002200; Larkin Rpt. (Pl. Ex. 1189) at 118.

7. Purchase Order 01759-071-7X, Mar. 26, 1987 (Pl. Ex. 669); Hekking Rpt. (Pl. Ex. 1) at 287.

8. Request for Design Revision No. MR-05-106, Oct. 29, 1986 (Pl. Ex. 129) at AEPHQ151579; Hekking Rpt. (Pl. Ex. 1) at 286.

9. Memo, 900 H.P. PA Fan Motor (Pl. Ex. 670); Koppe Rpt. (Pl. Ex. 858) at 193; Tuppeny Rpt. (Def. Ex. 1524) at 92.

10. Cardinal 1, 2 & Musk. Riv. 5, New 900 HP Motors, Mar. 23, 1988 (Pl. Ex. 877); Koppe Rpt. (Pl. Ex. 858) at 193.

11. Final In Service Report #4, Sept. 16, 1988 (Jt. Ex. 177); Hekking Rpt. (Pl. Ex. 1) at 287.

12. Capital Improvement Req. # 72202 (Jt. Ex. 250) at 1RP002204; 600 MW Big Fix Modifications, Mar. 21, 1977 (Pl. Ex. 1030); Hekking Rpt. (Pl. Ex. 1) at 285; Tuppeny Rpt. (Def. Ex. 1524) at 92.

13. Capital Improvement Req. # 72202 (Jt. Ex. 250) at 1RP002204; Hekking Rpt. (Pl. Ex. 1) at 285.

14. Capital Improvement Req. # 72202 (Jt. Ex. 250) at 1RP002204; Cardinal Units 1 & 2 and Muskingum River Unit 5 P.A. Fan Motors, Jan. 28, 1987 (Jt. Ex. 22) at AEPHQ151506; Hekking Rpt. (Pl. Ex. 1) at 285-286; Tuppeny Rpt. (Def. Ex. 1524) at 92.

15. Capital Improvement Req. # 72202 (Jt. Ex. 250) at 1RP002207; Hekking Rpt. (Pl. Ex. 1) at 286.

16. Capital Improvement Req. # 72202 (Jt. Ex. 250) at 1RP002204.

17. Capital Improvement Req. # 72202 (Jt. Ex. 250) at 1RP002204; Hekking Rpt. (Pl. Ex. 1) at 287; Tuppeny Rpt. (Def. Ex. 1524) at 91.

18. Work Order Completion Report, 705/2310 (Jt. Ex. 77); Property Location Ledger (Pl. Ex. 1280) at AT003782; Larkin Rpt. (Pl. Ex. 1189) at 117.

ATTACHMENT B-19
Muskingum River 5: CI 71966[1]

Unit Info./ Activity	585 MW/1968[2] CI 71966: Redesigned and replaced the economizer; approved by the Chairman on May 11, 1984 and the Board of Directors on May 30, 1984.[3] CI 71966, Rev. 1: Reduced approval amount by $1,098,000; approved by the Chairman on March 5, 1987 and the Board of Directors on March 18, 1987.[4]
Nature	AEP hired B&W to design the project.[5] The replacement included a redesign of the economizer "in order to reduce gas velocities and thereby extend the life of the economizer from the present 15 year to approximately 25 years."[6] The project was approved by more than 10 people, including the company president and chairman of the board of directors.[7] The costs of the project were capitalized; AEP considered the work a "major capital" project.[8]
Extent	AEP replaced the entire economizer with a redesigned component.[9] Each of the 251 economizer tube assemblies had to be removed one-by-one using two monorails and a crane with a 175-foot arm.[10]
Outage Dates	The outage lasted from March 30, 1985 to July 15, 1985.[11]
Purpose	AEP's expert concluded that the company decided to redesign and replace the economizer in response to accumulated damage to the component, "continued poor reliability and increasing forced outage hours."[12] Economizer breakdowns caused 249 hours of forced outages in 1982 and 518 hours in 1983.[13] Without the replacement, that total was expected to continue to increase until reaching 728 hours in 1987.[14] With the replacement, AEP expected to save $95,000 per year in maintenance costs, gain an additional $2,236,000 in sales revenue, and improve the unit's efficiency (heat rate).[15]
Frequency	The project marked the first time the economizer was replaced.[16]
Capital Cost	It cost $3,341,946 for installation.[17]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-216 and 288-292.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145020; Joint Stips. ¶¶165 and 166; Hekking Rpt. (Pl. Ex. 1) at 216.

3. Capital Improvement Req. # 71966 (Jt. Ex. 131) at ARC-CORPB-COL109532; Hekking Rpt. Pl. Ex. 1) at 289.

4. Capital Improvement Req. # 71966 Rev. 1 (Jt. Ex. 130) at ARC-CORPB-COL109520-521.

5. Executive Summary Purchase Order #28164-071-4, Aug. 24, 1984 (Pl. Ex. 386); Hekking Rpt. (Pl. Ex. 1) at 289.

6. Executive Summary Purchase Order #28164-071-4, Aug. 24, 1984 (Pl. Ex. 386); Hekking Rpt. (Pl. Ex. 1) at 289.

7. Capital Improvement Req. # 71966 (Jt. Ex. 131) at ARC-CORPB-COL109532.

8. Muskingkum River Year 1985 (Pl. Ex. 383) at ARC-MR127027; Work Order Completion Report, 704/9460 (Jt. Ex. 201); Larkin Rpt. (Pl. Ex. 1189) at 112-113.

9. Capital Improvement Req. # 71966 (Jt. Ex. 131) at ARC-CORPB-COL109537.

10. Trip Report, Muskingum River 5 Economizer Replacement Project, Jan. 11, 1984 (Pl. Ex. 663); Tuppeny Rpt. (Def. Ex. 1524) at 89; Hekking Rpt. (Pl. Ex. 1) at 290.

11. Work Order Completion Report, 704/9460 (Jt. Ex. 201); Hekking Rpt. (Pl. Ex. 1) at 290.

12. Tuppeny Rpt. (Def. Ex. 1524) at 89; Kevin Stogran Depo. at 48:16-23, 51:20-52:17, 59:1-16 and 60:19-61:5.

13. Capital Improvement Req. # 71966 (Jt. Ex. 131) at ARC-CORPB-COL109537; Kevin Stogran Depo. at 56:11-23.

14. Capital Improvement Req. # 71966 (Jt. Ex. 131) at ARC-CORPB-COL109537.

15. Capital Improvement Req. # 71966 (Jt. Ex. 131) at ARC-CORPB-COL109537; Hekking Rpt. (Pl. Ex. 1) at 289.

16. Capital Improvement Req. # 71966 (Jt. Ex. 131) at ARC-CORPB-COL109536; Hekking Rpt. (Pl. Ex. 1) at 292.

17. Property Records (Pl. Ex. 1280) at AT003777; Work Order Completion Report, 704/9460 (Jt. Ex. 201); Hekking Rpt. (Pl. Ex. 1) at 290; Larkin Rpt. (Pl. Ex. 1189) at 112.

ATTACHMENT B-20
Muskingum River Unit 5: CI 72632[1]

Unit Info./ Activity	585 MW/1968[2] CI 72632: Replaced the first reheat superheater outlet bank; approved by the Chairman on August 9, 1991.[3]
Nature	AEP hired Babcock and Wilcox to fabricate the new tube assemblies and associated tube legs and Legge Associates to install them.[4] The new tubes were made with upgraded material that AEP expected to last for "the remaining life of the unit."[5] The project was approved by more than 10 people, including the company president and chairman of the board of directors.[6] AEP capitalized the costs of the project.[7]
Extent	AEP replaced the first reheater outlet bank, which consisted of 125 assemblies.[8] It estimated 23,000 man-hours would be needed to remove the old components and install their replacements.[9] The replacement required Legge to cut an access opening in the floor of the convection pass directly under the reheat elements, and the use of monorails and a tower crane to remove individual elements and install new ones.[10]
Outage Dates	The outage lasted from March 21, 1992 to June 14, 1992.[11]
Purpose	The project was intended to prevent tube failures due to coal ash corrosion, reduce unit forced outages, and allow the unit to operate at the designed temperature.[12] Tube samples taken during the inspection showed that tubes lost up to 45% of original wall thickness due to coal ash corrosion.[13] After the 1990 scheduled outage, the unit suffered three forced outages because of tube failures and AEP expected this occurrence to become increasingly frequent if the component was not replaced.[14] AEP projected that, if the replacement did not occur, the existing first reheat outlet bank would initially cause 192 hours of forced outage per year, which would increase at 14% per year until the component was replaced.[15] From the time between preparation of the project justification (6/91) and the start of the planned outage when the replacement occurred, the reheater actually caused 852 hours of forced outage per year.[16] AEP identified the reheat replacement as necessary to operate the unit for 50 years.[17]
Frequency	The project marked the first time that the first reheat superheater outlet bank was replaced.[18]
Capital Cost	The cost was $2,665,038 for installation.[19]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-216 and 299-303.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145020; Joint Stips. ¶¶165 and 166; Hekking Rpt. (Pl. Ex. 1) at 216.

3. Capital Improvement Req. # 72632 (Jt. Ex. 2) at 1RP002030; Hekking Rpt. (Pl. Ex. 1) at 300 and 301.

4. Contract Letter MR5-1191, Jan. 24, 1992 (Pl. Ex. 381); Tuppeny Rpt. (Def. Ex. 1524) at 97-98; Hekking Rpt. (Pl. Ex. 1) at 301-302.

5. Capital Improvement Req. # 72632 (Jt. Ex. 2) at 1RP002038; Hekking Rpt. (Pl. Ex. 1) at 300.

6. Capital Improvement Req. # 72632 (Jt. Ex. 2) at 1RP002030.

7. Capital Improvement Req. # 72632 (Jt. Ex. 2) at 1RP002033; Hekking Rpt. (Pl. Ex. 1) at 301.

8. Specification MR5-1191 (Pl. Ex. 993) at ARC-MR112298; Tuppeny Rpt. (Def. Ex. 1524) at 97-98.

9. Capital Improvement Req. # 72632 (Jt. Ex. 2) at 1RP002035.

10. Legge Associates - Rigging Concept (Pl. Ex. 667); Letter, Specification MR5-1191, Dec. 19, 1991 (Pl. Ex. 382); Summary of Major Work, 1992 Outage (Pl. Ex. 333); Hekking Rpt. (Pl. Ex. 1) at 302.

11. Memo, Outage Plans for 1992, Jan. 27, 1992 (Jt. Ex. 47); Tuppeny Rpt. (Def. Ex. 1524) at 98; Hekking Rpt. (Pl. Ex. 1) at 302.

12. Capital Improvement Req. # 72632 (Jt. Ex. 2) at 1RP002033 and 002039; Hekking Rpt. (Pl. Ex. 1) at 301.

13. Capital Improvement Req. # 72632 (Jt. Ex. 2) at 1RP002033; Tuppeny Rpt. (Def. Ex. 1524) at 97; Hekking Rpt. (Pl. Ex. 1) at 300.

14. Capital Improvement Req. # 72632 (Jt. Ex. 2) at 1RP002038; Tuppeny Rpt. (Def. Ex. 1524) at 97; Hekking Rpt. (Pl. Ex. 1) at 300.

15. Capital Improvement Req. # 72632 (Jt. Ex. 2) at 1RP002038; Koppe Rpt. (Pl. Ex. 858) at 191.

16. Koppe Rpt. (Pl. Ex. 858) at 192.

17. MRP 1-4 and MRP 5 50 Year and 60 year Life Cost Summaries (Pl. Ex. 361) at ARC-MR107007; Hekking Rpt. (Pl. Ex. 1) at 301.

18. Capital Improvement Req. # 72632 at 1RP002033 (Jt. Ex. 2); Hekking Rpt. (Pl. Ex. 1) at 300.

19. Property Location Ledger, May 1998 (Pl. Ex. 457) at AT004168; Larkin Rpt. (Pl. Ex. 1189) at 116; Hekking Rpt. (Pl. Ex. 1) at 302.

ATTACHMENT B-21
Muskingum River 5: CI 72372[1]

Unit Info./ Activity	585 MW/1968[2] CI 72372: Installation of Lower Furnace Tubes; approved by the Chairman on September 12, 1988 and the Board of Directors on September 28, 1988.[3]
Nature	AEP hired Babcock & Wilcox to make the new components and install them, because they were "the only qualified manufacturer considering design and complexity of the lower furnace and the design modifications we require."[4] The project included several design improvements and upgrades in the material used for the replacements.[5] The project was approved by more than 10 AEP officials, including the company president and the chairman of the board of directors.[6] The costs of the project were capitalized.[7]
Extent	The entire lower two-thirds of the furnace (about 120 vertical feet) was replaced, including the lower primary furnace consisting of the entire first and second pass tubing with its inlet and outlet headers, and third pass tubes and inlet headers in the mix area.[8] The first pass and second pass tubing consisted of 774 and 742 tubes, respectively.[9] AEP estimated it would take more than 214,000 man-hours to remove the old components and install their replacements.[10] The scope of work was to span three years (1990 through 1992).[11] The lower furnace was shipped and installed in panels, each panel was approximately 15-20 feet in width and 60 feet in length.[12] Furnace replacement panels were transported to the plant over a period of time by truck and removed from the trucks by lifting rigs.[13]
Outage Dates	AEP replaced the front half of the lower furnace during a planned outage from August 22, 1990 through November 18, 1990, and replaced the rear half during a planned outage from March 20, 1992 through June 15, 1992.[14]
Purpose	AEP expected the replacement to increase unit availability by 13% while also reducing maintenance costs.[15] The deteriorated condition of the lower furnace tubes had been responsible for 30% of the forced outages in the five years preceding the preparation of the CI, for an average forced unit outage rate of 4.6% due solely to furnace wall problems.[16] AEP identified its 600 MW units, including Muskingum River Unit 5, as needing a furnace replacement program because such units could only operate two to three weeks without having an outage.[17] AEP projected that tube leaks in the lower furnace would cause 1152 hours per year of forced outage time (escalating at a rate of 20% per year), at a cost of $2,129,074 per year in lost sales, if the tubes were not replaced.[18] The replacements were expected to extend the life of the unit by 25 years and were considered part of AEP's life extension program.[19]
Frequency	This was the first time that the lower furnace was replaced in its entirety.[20]
Capital Cost	$13,350,801 for installation only.[21]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-216 and 292-299.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145020; Joint Stips. ¶¶165 and 166; Hekking Rpt. (Pl. Ex. 1) at 216.

3. Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136764-765.

4. Muskingum River Unit 5 Lower Furnace Replacement, Oct. 3, 1988 (Jt. Ex. 14); 600 MW Series Generators, Furnace Wall and Economizer Replacements, Contract Letters CD 1&2-90 and MR5-90, Dec. 18, 1989 (Jt. Ex. 38); Tuppeny Rpt. (Def. Ex. 1524) at 95-96; Hekking Rpt. (Pl. Ex. 1) at 296 and 297.

5. Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136770; Specification CD/MR-0589 (Pl. Ex. 378); Muskingum River Unit 5 Furnace Replacement, July 28, 1989 (Pl. Ex. 96); B&W Quotation for Additional Engineering and Material, Jul. 19, 1989 (Pl. Ex. 97); Lower Furnace Replacement for CD-1, CD-2, and M-5 Balance Draft Conversion, Apr. 6, 1989 (Pl. Ex. 98); Babcock & Wilcox Proposal P11-2054, Aug. 2, 1988 (Pl. Ex. 465); Additional Information and Quotations, Nov. 16, 1988 (Pl. Ex. 276); Tuppeny Rpt. (Def. Ex. 1524) at 95; Koppe Rpt. (Pl. Ex. 858) at 188; Hekking Rpt. (Pl. Ex. 1) at 296.

6. Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136765.

7. Capital Improvement Req. # 72372 (Jt. Ex. 39).

8. Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136765; Specification CD/MR-0589 (Pl. Ex. 378); Koppe Rpt. (Pl. Ex. 858) at 187; Hekking Rpt. (Pl. Ex. 1) at 294 and 296.

9. Muskingum River Plant Unit 5, Descriptive Article MR-5-1-11, Mar. 21, 1968 (Pl. Ex. 397); Tuppeny Rpt. (Def. Ex. 1524) at 93-94; Hekking Rpt. (Pl. Ex. 1) at 293.

10. Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136774.

11. Hekking Rpt. at 297 (Pl. Ex. 1); Specification CD/MR-0589 (Pl. Ex. 378); Hekking Rpt. (Pl. Ex. 1) at 297.

12. David Wehner Depo. at 88:13-88:24 and 89:1-89:3.

13. Memo, Notes from 7/18/90 Post-Outage Meeting, Aug. 13, 1990 (Pl. Ex. 1947); David Wehner Depo. at 89:4-89:14, 89:18-89:24 and 90:1-90:15.

14. NERC GADS Data CD (Pl. Ex. 1181); Muskingum River Unit 5 Annual Outage Report, 1990 (Jt. Ex. 78) at MR165048; David Wehner Depo. at 95:5-95:21; Koppe Rpt. (Pl. Ex. 858) at 187; Hekking Rpt. (Pl. Ex. 1) at 298.

15. Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136770; Hekking Rpt. (Pl. Ex. 1) at 295.

16. Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136769; Tuppeny Rpt. (Def. Ex. 1524) at 95; Hekking Rpt. (Pl. Ex. 1) at 295.

17. David Wehner Depo. at 28:24-29:11.

18. Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136775; Koppe Rpt. (Pl. Ex. 858) at 189.

19. Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136770; 600 MW Series 60 Year Life: Equipment Description and Reasons for Replacements (Pl. Ex. 168); Muskingum River Plant Life Extension Program-Unit 5, Jul. 1, 1987 (Pl. Ex. 169); 50 And 60 Year Service Life, Dec. 19, 1991 (Pl. Ex. 21); Supercritical Fossil Units Service Life, Aug. 7, 1992 (Pl. Ex. 123); Wehner Depo. at 133:12-133:24 and 136:10-136:20; Hekking Rpt. (Pl. Ex. 1) at 294 and 295.

20. Tuppeny Rpt. (Def. Ex. 1524) at 94; Hekking Rpt. (Pl. Ex. 1) at 295 and 299; Capital Improvement Req. # 72372 (Jt. Ex. 39) at ARC-CORPB-COL136769.

21. Property Location Ledger, May 1998 (Pl. Ex. 457) at AT004157, 004159-161, 004165-171, 004175; Larkin Rpt. (Pl. Ex.1189) at 114; Hekking Rpt. (Pl. Ex. 1) at 298.

ATTACHMENT B-22
Tanners Creek 3: CI 31236[1]

Unit Info./ Activity	205 MW/1954[2] CI 31236: Replaced reheat outlet tubes, primary superheat outlet tubes, the two reheat outlet headers, and the reheat outlet header vestibule; the project; approved by the AEP Board of Directors on July 29, 1987.[3] CI 31236, Rev. 1: Increased approval amount by $200,000; prepared on December 29, 1987.[4]
Nature	AEP hired an outside contractor, Combustion Engineering, to remove and install the reheat and primary superheat materials.[5] In order to improve the performance of the unit, the new components were made of different materials and designed differently than those they replaced.[6] The project was approved by more than 10 people, including AEP president and chairman of the board of directors before approval by the board.[7] The project was funded with capital funds.[8]
Extent	The replaced reheater bank consisted of 168 tube assemblies and two 28-foot-long headers, while the primary superheater consisted of 168 tube assemblies.[9] Each was completely replaced.[10] Contractors cut a hole in the structure and built three monorails to move the components; once out of the structure, they were lowered to the ground by a hoist.[11]
Outage Dates	The outage lasted from February 13, 1988 to April 16, 1988.[12]
Purpose	The sole purpose of the project was to restore the unit's availability.[13] The project was intended to eliminate "a major cause of outages" at the unit, and was "required to restore the unit to a high availability."[14] AEP projected that the work would eliminate 12 days of forced outages per year, with the outage hours escalating at 10 percent per year as the components deteriorated further.[15] In the five years from 1983 to 1987, reheater problems accounted for 57 percent of the unit's forced outages, and the company expected the project would "eliminate the forced unit outages caused by long term creep of the tube material.[16] AEP expected the project to eliminate $158,443 annually in maintenance and inefficiency costs while also allowing the unit to generate an additional $192,175 in annual electricity sales by avoiding forced outages attributed to the replaced equipment.[17]
Frequency	This was the only time this project was done at the unit; the horizontal reheat section and the primary superheat outlet banks were original equipment.[18]
Capital Cost	$1,968,589[19]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 353-358.

2. Joint Stip. ¶¶225 and 227; Hekking Rpt. (Pl. Ex. 1) at 353.

3. Capital Improvement Req. # 31236 (Jt. Ex. 113) at AEPHQ146654-655; Hekking Rpt. (Pl. Ex. 1) at 355.

4. Capital Improvement Req. # 31236, Rev. 1 (Jt. Ex. 112) at AEPHQ 146642.

5. Contract Letter TC3-1087, Jan. 11, 1988 (Pl. Ex. 821); Hekking Rpt. (Pl. Ex. 1) at 355-356.

6. Daniel M. Duellman Depo. at 37:15-39:24.

7. Capital Improvement Req. # 31236 (Jt. Ex. 113) at AEPHQ146654-655.

8. Tanners Creek Generating Plant (Pl. Ex. 1279) at AT002771-772; Capital Improvement Req. # 31236 (Jt. Ex. 113); Tanners Creek Unit 3 Scheduled Outage, Feb. 13, 1988 to Apr. 16, 1988 (Jt. Ex. 101) at TC138385.

9. Specification TC3-1087 (Pl. Ex. 1175) at TC144575; Tuppeny Rpt. (Def. Ex. 1524) at 22; Hekking Rpt. (Pl. Ex. 1) at 356.

10. Id.

11. Tanners Creek Unit 3 Scheduled Outage, Feb. 13, 1988 to Apr. 16, 1988 (Jt. Ex. 101) at TC138388-389; Hekking Rpt. (Pl. Ex. 1) at 356-357.

12. Outage Summary Tanners Creek Unit 3 1988 Scheduled Outage (Pl. Ex. 451); Tanners Creek Unit 3 Scheduled Outage, Feb. 13, 1988 to Apr. 16, 1988 (Jt. Ex. 101) at TC138385; Hekking Rpt. (Pl. Ex. 1) at 356.

13. Daniel M. Duellman Depo. at 40:1-17.

14. Capital Improvement Req. # 31236 (Jt. Ex. 113) at AEPHQ146658; Daniel M. Duellman Depo. at 39:8-40:17; Hekking Rpt. (Pl. Ex. 1) at 357.

15. Capital Improvement Req. # 31236 (Jt. Ex. 113) at AEPHQ146662-664; Hekking Rpt. (Pl. Ex. 1) at 355.

16. Percentage of Total Forced Outage and Lost Partial Hours by Component, Tanners Creek Unit 3, 1983 - 1987 (Pl. Ex. 1975) at ARC-PSESV-COL147180; Capital Improvement Req. # 31236, Rev.1 (Jt. Ex. 112) at AEPHQ1446646; Unit Operating History: Equipment Survey for Tanners Creek Unit 3 (Pl. Ex. 1976) at ARC-PSESV-COL147186; Hekking Rpt. (Pl. Ex. 1) at 357.

17. Capital Improvement Req. # 31236 (Jt. Ex. 113) at AEPHQ146662-663; Hekking Rpt. (Pl. Ex. 1) at 355.

18. Capital Improvement Req. # 31236 (Jt. Ex. 113) at AEPHQ146658; Hekking Rpt. (Pl. Ex. 1) at 355.

19. Work Order Completion Rpt. and Statement of Cost Allocation (Jt. Ex. 99) at TC121354; Hekking Rpt. (Pl. Ex. 1) at 357; Larkin Rpt. (Pl. Ex. 1189) at 140.

ATTACHMENT B-23
Tanners Creek 4: CI 31140[1]

Unit Info./ Activity	500 MW/1964[2] CI 31140: Replaced all 11 cyclone furnaces, reentrant throat panels, primary burners, and related equipment; approved by the Chairman on June 25, 1986, and the Board of Directors on July 30, 1986.[3]
Nature	AEP contracted with Babcock & Wilcox to build and install the new components, believing that, because of the complexity and importance of the job, Babcock & Wilcox was the only entity "capable of engineering and assuring the reliability of the major components called for in this specification."[4] The project included numerous design improvements and new features for the replacement components.[5] The project was approved by more than 10 people, including the company president and chairman of the board of directors.[6] The costs of the project were capitalized.[7]
Extent	The project involved the replacement of the entire set of cyclones and related equipment, including large portions of the front and rear wall panels.[8] Babcock & Wilcox installed a monorail to remove old components and relied an "extensive" rigging system to hoist in the new components.[9] Each cyclone has a diameter of approximately 10 feet, is 14 feet 9 inches high, and 13 feet 6 inches long.[10] The wall panels were approximately 18 feet long, ranging from 24 to 64 tubes wide.[11] Babcock & Wilcox employed up to 47 welders during the installation of the new equipment.[12]
Outage Dates	The outage lasted from August 25, 1987 to December 12, 1987.[13]
Purpose	The cyclone replacement was part of an effort to "extend the expected life" of the equipment in Tanners Creek 4.[14] The project was expected to improve the reliability of the components for the next 20 years.[15] AEP projected that the replacement would eliminate 723 hours of forced outages and curtailments annually, with the lost hours escalating at six percent per year due to the deterioration of the cyclone tubing.[16] AEP attributed 40 percent of the unit's outages to the cyclones, and believed replacing the cyclones would reduce forced outages.[17] AEP expected the project would result in annual savings of $990,000 in maintenance costs and generate an additional $1.2 million in annual electricity sales by avoiding forced outages attributed to the cyclones.[18]
Frequency	All the replaced equipment was original to the unit except the cyclone tubing and reentrant throat tube and wall tube panels, which had been replaced once previously.[19]
Capital Cost	$12,172,150[20]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 353-354 and 358-364.

2. Joint Stip. ¶¶228 and 230; Hekking Rpt. (Pl. Ex. 1) at 353.

3. Capital Improvement Req. # 31140 (Jt. Ex. 21) at AEPHQ146844-845; Hekking Rpt. (Pl. Ex. 1) at 361.

4. Cyclone Replacement Project Agreement, Sept. 2, 1986 (Pl. Ex. 794); Request for Quotation, Tanners Creek Unit 4 Cyclone Replacement, May 10, 1985 (Pl. Ex. 797); Hekking Rpt. (Pl. Ex. 1) at 360; Tuppeny Rpt. (Def. Ex. 1524) at 72.

5. Tanners Creek Generating Station Unit 4 Outage, Aug. 25, 1987 - Dec. 12, 1987 (Pl. Ex. 1176) at TC176729; Cyclone Replacement and Re-Entries (Jt. Ex. 106) at TC176013-014; Hekking Rpt. (Pl. Ex. 1) at 359 and 362; Tuppeny Rpt. (Def. Ex. 1524) at 71.

6. Capital Improvement Req. # 31140 (Jt. Ex. 21) at AEPHQ146844-845.

7. Capital Improvement Req. # 31140 (Jt. Ex. 21) at AEPHQ146849; Hekking Rpt. (Pl. Ex. 1) at 360.

8. Capital Improvement Req. # 31140 (Jt. Ex. 21) at AEPHQ146844-845; Specification TC-SG-101, Revision No. 1 (Pl. Ex. 795) at TC112553; Hekking Rpt. (Pl. Ex. 1) at 362.

9. Rigging Sketches (Pl. Ex. 800) at TC113507-507 and (Pl. Ex. 803) at TC113421; Hekking Rpt. (Pl. Ex. 1) at 363.

10. Cyclone Dimensions (Pl. Ex. 799) at TC113502; Hekking Rpt. (Pl. Ex. 1) at 359.

11. Specification TC-SG-101, Revision No. 1 (Pl. Ex. 795) at TC112553; Hekking Rpt. (Pl. Ex. 1) at 362.

12. Cyclone Dimensions (Pl. Ex. 799) at TC113503.

13. Tanners Creek Generating Station Unit 4 Outage, Aug. 25, 1987 - Dec. 12, 1987 (Pl. Ex. 1176) at TC176650; Hekking Rpt. (Pl. Ex. 1) at 362.

14. Tanners Creek Unit 4 Trip Report, April 3, 1986 (Pl. Ex. 1988) at STGEN-HQ100028.

15. Capital Improvement Req. # 31140 (Jt. Ex. 21) at AEPHQ146850.

16. Capital Improvement Req. # 31140 (Jt. Ex. 21) at AEPHQ146857-865; Jeff Brediger Depo. at 60:17-62:12.

17. Capital Improvement Req. # 31140 (Jt. Ex. 21) at AEPHQ146849; Five Year Plan Tanners Creek Plant, January 30, 1986 (Pl. Ex. 1973) at ARC-PSESV-COL117155; Hekking Rpt. (Pl. Ex. 1) at 360; Tuppeny Rpt. (Def. Ex. 1524) at 71.

18. Capital Improvement Req. # 31140 (Jt. Ex. 21) at AEPHQ146850 and 146862-865; Hekking Rpt. (Pl. Ex. 1) at 360-361.

19. Capital Improvement Req. # 31140 (Jt. Ex. 21) at AEPHQ146855; Hekking Rpt. (Pl. Ex. 1) at 360; Tuppeny Rpt. (Def. Ex. 1524) at 71.

20. Tanners Creek Generating Plant (Pl. Ex. 454); Hekking Rpt. (Pl. Ex. 1) at 363; Larkin Rpt. (Pl. Ex. 1189) at 142.

ATTACHMENT B-24
Tanners Creek 4: CI 31378[1]

Unit Info./ Activity	500MW/1964[2] CI 31378: Furnace arch and convection floor pass tubing; approved by the Chairman on December 9, 1988.[3] CI 31378, Rev. 1: Increased approval amount by $439,000; approved on April 19, 1989.[4]
Nature	AEP hired B&W to fabricate and Legge to replace the unit's rear wall arch tubes and convection pass floor tubes.[5] The project was approved by more than 10 people, including the AEP president and chairman of the board of directors.[6] The work was funded as a capital project.[7]
Extent	AEP replaced 432 tubes in the rear wall arch and 432 tubes in the convection pass floor, and classified the replacement as an "altered boiler design."[8] After all of the new tubing was installed, a new header vestibule was installed.[9] AEP estimated that it would require 30,420 manhours to complete the project.[10]
Outage Dates	The outage lasted from October 29, 1989 to December 31, 1989.[11]
Purpose	The project was intended solely to restore the unit's availability by eliminating forced outages caused by tube leaks.[12] AEP expected the project would reduce maintenance costs by as much as $300,000 per year, and eliminate approximately 264 hours of forced outages each year, resulting in additional revenue of $351,405.[13]
Frequency	The project was the first time the convection pass floor tubing was replaced.[14] The rear arch tubing was replaced in 1969.[15]
Capital Cost	$1,417,041[16]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 353-354 and 365-370.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145022; Joint Stip. ¶¶228 and 230; Hekking Rpt. (Pl. Ex. 1) at 353.

3. Capital Improvement Req. # 31378 (Jt. Ex. 114) at AEQPH146811; Hekking Rpt. (Pl. Ex. 1) at 366.

4. Capital Improvement Req. # 31378, Rev. 1 (Jt. Ex. 193) at AEQPH146796; Improvement Requisition Approval Notice, Apr. 19, 1989 (Jt. Ex. 194).

5. Work Order, 772/0447 and 872/0447 (Jt. Ex. 105) at TC170804; Hekking Rpt. (Pl. Ex. 1) at 367; Tuppeny Rpt. (Def. Ex. 1524) at 68 and 69.

6. Capital Improvement Req. # 31378 (Jt. Ex. 114) at AEQPH146811.

7. Capital Improvement Req. # 31378 (Jt. Ex. 114) at AEQPH146816.

8. Tanners Creek Generating Station Unit 4 Outage, Oct. 26, 1989 to Dec. 31, 1989 (Jt. Ex. 144) at ARC-TC101542; Tanners Creek Generating Station Unit 4 Outage, October 26, 1989 – December 31, 1989 (Pl. Ex. 810) at TC125220-221; Hekking Rpt. (Pl. Ex. 1) at 367 and 368.

9. Tanners Creek Generating Station Unit 4 Outage, October 26, 1989 – December 31, 1989 (Pl. Ex. 810) at TC125190-198 and TC125211; Hekking Rpt. (Pl. Ex. 1) at 368.

10. Tanners Creek Generating Station Unit 4 Outage, Oct. 26, 1989 to Dec. 31, 1989 (Jt. Ex. 144) at ARC-TC101269; Hekking Rpt. (Pl. Ex. 1) at 367.

11. Tanners Creek Generating Station Unit 4 Outage, Oct. 26, 1989 to Dec. 31, 1989 (Jt. Ex. 144) at ARC-TC101241; Hekking Rpt. (Pl. Ex. 1) at 368; Tuppeny Rpt. (Def. Ex. 1524) at 68.

12. Capital Improvement Req. # 31378 (Jt. Ex. 114) at AEQPH146811; Daniel Duellman Depo. at 60:23-61:8 and 62:4-11; Hekking Rpt. (Pl. Ex. 1) at 365-366.

13. Capital Improvement Req. # 31378, Rev. 1 (Jt. Ex. 193) at AEQPH146803; Daniel Duellman Depo. at 66:1-4; Hekking Rpt. (Pl. Ex. 1) at 366.

14. Capital Improvement Req. # 31378 (Jt. Ex. 114) at AEQPH146811; Hekking Rpt. (Pl. Ex. 1) at 365.

15. Capital Improvement Req. # 31378 (Jt. Ex. 114) at AEQPH146816; Tuppeny Rpt. (Def. Ex. 1524) at 68.

16. Electric Plant in Service - Structures and Equipment, Indiana & Michigan Electric Co., Tanners Creek Generating Plant (Pl. Ex. 1279) at AT002778 and 002788; Work Order Completion Rpt, 772/0447 (Jt. Ex. 104); Hekking Rpt. (Pl. Ex. 1) at 368; Larkin Rpt. (Pl. Ex. 1189) at 147.

ATTACHMENT B-25
Tanners Creek 4: CI 31737[1]

Unit Info./ Activity	500MW/1964[2] CI 31737: Replaced secondary superheater intermediate and outlet bank and headers; approved by the Chairman on September 8, 1997 and the Board of Directors on September 24, 1997.[3]
Nature	AEP hired Babcock and Wilcox to fabricate and replace the unit's intermediate and outlet banks of the secondary superheater and two outlet headers.[4] The replacement incorporated design improvements, including, but not limited to, replacing the two original outlet headers with a single header, redesign of the header steam outlet piping, and use of newly developed high temperature alloy steel in the tubing, which allowed for thinner tubes without sacrificing strength.[5] CI 31737 was prepared by the Fossil Plant Engineering Division of AEPSC and approved by nine people including the chairman of the company board of directors.[6] The work was funded as a capital project.[7]
Extent	Replaced intermediate and outlet banks of secondary suerheater and the two outlet headers. The new outlet header was delivered in two sections that together weighed more than 28 tons, while the 35 tube modules for the intermediate and outlet banks weighed 17,700 pounds each.[8]
Outage Dates	The outage occurred from September 18, 1998 to December 9, 1998.[9]
Purpose	AEP conducted the replacements in order to eliminate a source of rapidly escalating forced outages.[10] The company attributed 13 forced outages in approximately two years to the replaced components and noted that the failures were escalating at a 30% rate per year, despite a reduction in the main steam temperature to try to abate the escalation.[11] AEP had planned to replace the components in 2000, but determined that without the replacements, the unit could not "operate in a manner even approaching reasonable reliability."[12] The maintenance costs associated with the leaks was $1,400,000.[13] AEP projected that replacing the superheater in 1998, rather than 2000, would save $1,394,000.[14]
Frequency	The project was the first time the intermediate and outlet banks and headers of the secondary superheater was replaced.[15]
Capital Cost	AEP estimated the project would cost $10,967,000.[16]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 353-354 and 370-378.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145022; Joint Stip. ¶¶228 and 230; Hekking Rpt. (Pl. Ex. 1) at 353.

3. Capital Improvement Req. # 31737 (Jt. Ex. 4) at AEP2NDJOINT0000054.

4. Contract/Service Order Total Evaluated Cost, Aug. 4, 1998 (Pl. Ex. 841); Contract Letter TC-LC-1025, August 13, 1988 (Pl. Ex. 842); Hekking Rpt. (Pl. Ex. 1) at 374 and 376; Tuppeny Rpt. (Def. Ex. 1524) at 73 and 74.

5. Capital Improvement Req. # 31737 (Jt. Ex. 4) at AEP2NDJOINT0000057; B&W Memo, "T23 Boiler Tube Material" (Pl. Ex. 819); Hekking Rpt. (Pl. Ex. 1) at 374 and 375-376.

6. Capital Improvement Req. # 31737 (Jt. Ex. 4) at AEP2NDJOINT0000054.

7. Work Order Completion Report, 772/0540 (Pl. Ex. 1376).

8. Scope of Work Specification TC-LC-1025, June 12, 1998 (Pl. Ex. 826) at TC154168; Hekking Rpt. (Pl. Ex. 1) at 375.

9. Koppe Rpt. (Pl. Ex. 858) at 229.

10. James Pianta Depo. at 110:6-16 and 170:4-10.

11. Capital Improvement Req. # 31737 (Jt. Ex. 4) at AEP2NDJOINT0000057; Hekking Rpt. (Pl. Ex. 1) at 373; Tuppeny Rpt. (Def. Ex. 1524) at 73.

12. Capital Improvement Req. # 31737 (Jt. Ex. 4) at AEP2NDJOINT0000057.

13. Capital Improvement Req. # 31737 (Jt. Ex. 4) at AEP2NDJOINT0000057; Tuppeny Rpt. (Def. Ex. 1524) at 73.

14. Capital Improvement Req. # 31737 (Jt. Ex. 4) at AEP2NDJOINT0000057; Hekking Rpt. (Pl. Ex. 1) at 374.

15. Capital Improvement Req. # 31737 (Jt. Ex. 4) at AEP2NDJOINT0000057; Hekking Rpt. (Pl. Ex. 1) at 373.

16. Capital Improvement Req. # 31737 (Jt. Ex. 4) at AEP2NDJOINT0000054; Larkin Rpt. (Pl. Ex. 1189) at 143; Hekking Rpt. (Pl. Ex. 1) at 373.

ATTACHMENT B-26
Tanners Creek 4: CI 31739[1]

Unit Info./ Activity	500MW/1964[2] CI 31739: Replaced front wall third pass tubes; submitted for approval in November of 1997.[3]
Nature	AEP hired Babcock and Wilcox to manufacture and replace the front wall third pass tubes.[4] CI 31739 was prepared by the Fossil Plant Engineering Division of AEPSC.[5] The work was funded as a capital project.[6]
Extent	The project involved the replacement of 432 tubes.[7] AEP estimated over 19,000 labor-hours would be needed to complete the project.[8]
Outage Dates	The outage lasted from September 18, 1998 to December 9, 1998.[9]
Purpose	The project was intended to "improve unit availability."[10] AEP discovered tube leaks in the front wall pass during three forced outages in 1997 and believed the tubes would have caused three outages if the superheater tubes had not failed first.[11] Prior to the project, the third pass tube leaks had been so numerous that no attempt was made to list each leak company records.[12] AEP projected that the replacement would prevent four forced outages of four days each annually.[13]
Frequency	The project was the first time the front wall third pass tubes were replaced.[14]
Capital Cost	AEP estimated the project would cost $2,066,000.[15]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 353-354 and 370-378.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145022; Joint Stip. ¶¶228 and 230; Hekking Rpt. (Pl. Ex. 1) at 353.

3. Capital Improvement Req. # 31739 (Jt. Ex. 249); Hekking Rpt. (Pl. Ex. 1) at 372.

4. Tuppeny Rpt. (Def. Ex. 1524) at 76; Hekking Rpt. (Pl. Ex. 1) at 376.

5. Capital Improvement Req. # 31739 (Jt. Ex. 249) at TC181098.

6. Capital Improvement Req. # 31739 (Jt. Ex. 249).

7. Capital Improvement Req. # 31739 (Jt. Ex. 249) at TC181098; Tuppeny Rpt. (Def. Ex. 1524) at 75; Hekking Rpt. (Pl. Ex. 1) at 371.

8. Capital Improvement Req. # 31739 (Jt. Ex. 249) at TC181103.

9. Tuppeny Rpt. (Def. Ex. 1524) at 76; Koppe Rpt. (Pl. Ex. 858) at 234; Hekking Rpt. (Pl. Ex. 1) at 372.

10. Capital Improvement Req. # 31739 (Jt. Ex. 249) at TC181100; Elie Dallal Depo. at 80:12-16; Hekking Rpt. (Pl. Ex. 1) at 377.

11. Capital Improvement Req. # 31739 (Jt. Ex. 249) at TC181100; Elie Dallal Depo. at 80:17-81:24.

12. Capital Improvement Req. # 31739 (Jt. Ex. 249) at TC181100; Elie Dallal Depo. at 78:3-80:11; Hekking Rpt. (Pl. Ex. 1) at 371-372; Tuppeny Rpt. (Def. Ex. 1524) at 76.

13. Capital Improvement Req. # 31739 (Jt. Ex. 249) at TC181104; Elie Dallal Depo. at 85:15-87:2; Hekking Rpt. (Pl. Ex. 1) at 372.

14. Capital Improvement Req. # 31739 (Jt. Ex. 249) at TC181100; Elie Dallal Depo. at 76:23-77:6; Hekking Rpt. (Pl. Ex. 1) at 376.

15. Capital Improvement Req. # 31739 (Jt. Ex. 249) at TC181098; Larkin Rpt. (Pl. Ex. 1189) at 144; Hekking Rpt. (Pl. Ex. 1) at 372 and 273.

ATTACHMENT B-27
Amos 1: CI 12012[1]

Unit Info./ Activity	800MW/1971[2] CI 12012: Installed additional economizer surface and support system; approved by AEP management on April 10, 1987.[3]
Nature	AEP hired Foster Wheeler to fabricate the materials and Union Boiler for installation and removal of the economizer surface and support system.[4] The project was classified as a capital project.[5]
Extent	Union Boiler replaced 172 tube assemblies in the steam generator economizer section, replacing the three-loop tubes with nine-loop tubes so as to increase the surface area of the economizer.[6] Numerous steel structure revisions were required to support the new tubes, and reinforcing bars were installed around the penetrations of the boiler needed to install the new steel work.[7] AEP estimated almost 30,000 hours would be needed to complete the project.[8]
Outage Dates	The outage lasted from May 5, 1989 through July 17, 1989.[9]
Purpose	Before replacement, AEP had to blow soot excessively to reduce gas temperatures and avoid support structure failure, which lead to increased forced outages and furnace wall and superheater tube maintenance due to erosion.[10] AEP predicted the project would insure the structural integrity of the economizer support system, improve boiler efficiency approximately 0.6% by reducing air heater outlet gas temperature, and reduce maintenance work and forced outages.[11] The present worth analysis showed a benefit of $5,000,000 over the life of the unit.[12] This included $100,000 per year by not having to bias the flow to the high pressure reheat and decreasing second reheat attemporation, $450,000 per year from reducing exit gas temperatures by 25°F and $60,000 in reduced maintenance costs. Four days of additional generation per year by avoiding a forced outage was also predicted.[13]
Frequency	The first and only economizer addition at Amos Unit 1 since the unit went into operation in 1971.[14]
Capital Cost	Final cost records not obtained. Estimated cost for entire project was $2,402,000 ($2,237,000 for installation and $165,000 for removal).[15] Property ledger records show a cost of $1,911,762 for economizer surface addition and support system.[16]

1. See generally Hekking Rpt. (Pl. Ex. 1) at 38-47.

2. Joint Stip. ¶15; Hekking Rpt. (Pl. Ex. 1) at 38.

3. Capital Improvement Req. # 12012 (Jt. Ex. 49); Hekking Rpt. (Pl. Ex. 1) at 42.

4. Summary of Outside Services (Pl. Ex. 243); Amos Unit 1, Scheduled Outage Rpt., Oct. 20, 1990 (Jt. Ex. 120) at AM163180; Hekking Rpt. (Pl. Ex. 1) at 44-45; Tuppeny Rpt. (Def. Ex. 1524) at 101.

5. Capital Improvement Req. # 12012 (Jt. Ex. 49) at ARC-MI108292.

6. Amos Unit 1, Scheduled Outage Rpt., Oct. 20, 1990 (Jt. Ex. 120) at AM163180; Summary of Outside Services (Pl. Ex. 243); Hekking Rpt. (Pl. Ex. 1) at 44-45; Tuppeny Rpt. (Def. Ex. 1524) at 101.

7. Amos Unit 1, Scheduled Outage Rpt., Oct. 20, 1990 (Jt. Ex. 120) at AM163180; Hekking Rpt. (Pl. Ex. 1) at 44-45; Tuppeny Rpt. (Def. Ex. 1524) at 101.

8. Capital Improvement Req. # 12012 (Jt. Ex. 49) at ARC-MI108297.

9. Amos Unit 1, Scheduled Outage Rpt., Oct. 20, 1990 (Jt. Ex. 120) at AM163168-169; Hekking Rpt. (Pl. Ex. 1) at 42; Tuppeny Rpt. (Def. Ex. 1524) at 101.

10. Capital Improvement Req. # 12012 (Jt. Ex. 49) at ARC-MI108294; Hekking Rpt. (Pl. Ex. 1) at 41; Tuppeny Rpt. (Def. Ex. 1524) at 100-101.

11. Capital Improvement Req. # 12012 (Jt. Ex. 49) at ARC-MI108294; S. A. Buchanan Depo. at 102:20-103:4; Hekking Rpt. (Pl. Ex. 1) at 41; Tuppeny Rpt. (Def. Ex. 1524) at 102.

12. Capital Improvement Req. # 12012 (Jt. Ex. 49) at ARC-MI108297-300; Hekking Rpt. (Pl. Ex. 1) at 42.

13. Id.; S. A. Buchanan Depo. at 130:2-131:12.

14. Hekking Rpt. (Pl. Ex 1) at 47.

15. Capital Improvement Req. # 12012 (Jt. Ex. 49) at ARC-MI108290; Hekking Rpt. (Pl. Ex. 1) at 45.

16. APC, Property Record Unit Ledger, Dec. 1997 (Pl. Ex. 452) at A.T. 000996; Hekking Rpt. (Pl. Ex. 1) at 45; Larkin Rpt. (Pl. Ex. 1189) at 24.